

Claims

[c1] What is claimed is:

1.A method of reducing a fringe field effect in an LCD, the LCD comprising a substrate having a plurality of pixels arranged in arrays, each pixel corresponding to a liquid crystal cell, the method comprising the following steps:

forming a bump on at least a side of each pixel for controlling inclined directions of liquid crystal molecules of each liquid crystal cell; and

forming a concave in each pixel of the substrate for fixing a position of a reverse domain due to the different inclined directions of the liquid crystal molecules in each liquid crystal cell.

[c2] 2.The method of claim 1 wherein each liquid crystal cell is a liquid crystal cell of an LCOS (liquid crystal on silicon) display.

[c3] 3.The method of claim 1 wherein each liquid crystal cell is driven by methods comprising dot inversion, frame inversion, and frame-plus-bias inversion.

[c4] 4.The method of claim 1 wherein modes of the liquid

crystal cell comprise TN (twisted nematic), reflective TN, ECB (electric controlled birefringence), VAN (vertical aligned nematic), and INV-TN (inverse twisted nematic).

- [c5] 5.The method of claim 1 wherein the bump is positioned on two opposite sides of each pixel, and the concave is positioned halfway between the bumps in each pixel.
- [c6] 6.The method of claim 1 wherein each bump is positioned around each pixel, and each concave is positioned at a symmetrical center of an area encompassed by the bump.
- [c7] 7.The method of claim 1 wherein the substrate further comprises a bottom layer, and the method further comprises forming an electrode layer on the bottom layer while a frame-plus-bias inversion driving method is applied.
- [c8] 8.The method of claim 7 wherein the electrode layer comprises at least an electrode, each electrode being positioned underneath the bump and corresponding to the bump for implementing the frame-plus-bias driving method.
- [c9] 9.A structure for reducing a fringe field effect in an LCD, the structure comprising:
a first substrate, the first substrate having a bottom layer

thereunder and a pixel defined thereon;
a liquid crystal cell comprising a plurality of liquid crystal molecules positioned above the first substrate;
at least a bump positioned on at least two opposite sides of the pixel of the first substrate for controlling inclined directions of the liquid crystal molecules;
a concave positioned in the pixel of the first substrate for fixing a position of a reverse domain due to the different inclined directions of the liquid crystal molecules above the concave; and
a second substrate positioned above the liquid crystal cell.

[c10] 10.The structure of claim 9 wherein the liquid crystal cell is a liquid crystal cell of an LCOS (liquid crystal on silicon) display.

[c11] 11.The structure of claim 9 wherein the bump comprises at least an insulating material.

[c12] 12.The structure of claim 11 wherein the insulating material comprises silicon oxide, silicon nitride, and inorganic materials.

[c13] 13.The structure of claim 9 wherein the liquid crystal cell is driven by methods comprising dot inversion, frame inversion, and frame-plus-bias inversion.

- [c14] 14.The structure of claim 9 wherein modes of the liquid crystal cell comprise TN (twisted nematic), reflective TN, ECB (electric controlled birefringence), VAN (vertical aligned nematic), and INV–TN (inverse twisted nematic).
- [c15] 15.The structure of claim 9 wherein the liquid crystal cell has a phase difference ranging from 150nm to 410nm.
- [c16] 16.The structure of claim 9 wherein the bump is bar-shaped.
- [c17] 17.The structure of claim 9 wherein the bump is circular.
- [c18] 18.The structure of claim 9 wherein the concave is bar-shaped.
- [c19] 19.The structure of claim 9 wherein the liquid crystal molecules incline from the bump toward the concave.
- [c20] 20.The structure of claim 9 wherein the concave fixes a position generated due to contrary inclined directions of the liquid crystal molecules close to the concave.
- [c21] 21.The structure of claim 9 wherein the first substrate further comprises at least an electrode positioned on the bottom layer, each electrode being positioned directly underneath the bump for implementing a frame-plus-bias inversion method.

- [c22] 22.The structure of claim 9 wherein the first substrate further comprises an electrode layer positioned on the bottom layer for implementing a frame-plus-bias inversion method.
- [c23] 23.The structure of claim 9 wherein the bump has a height ranging from $0.3\mu\text{m}$ to $3\mu\text{m}$.
- [c24] 24.The structure of claim 9 wherein the bump has a width ranging from $0.3\mu\text{m}$ to $20\mu\text{m}$.
- [c25] 25.The structure of claim 9 wherein the liquid crystal cell has a cell gap, the bump has a height, and a ratio of the height to the cell gap ranges from $1/15$ to 1 .
- [c26] 26.The structure of claim 9 wherein the concave has a depth ranging from $0.05\mu\text{m}$ to $3\mu\text{m}$.
- [c27] 27.The structure of claim 9 wherein the concave has a width ranging from $0.05\mu\text{m}$ to $20\mu\text{m}$.
- [c28] 28.The structure of claim 9 wherein the liquid crystal cell has a cell gap, the concave has a depth, and a ratio of the depth to the cell gap ranges from $1/50$ to $1/3$.